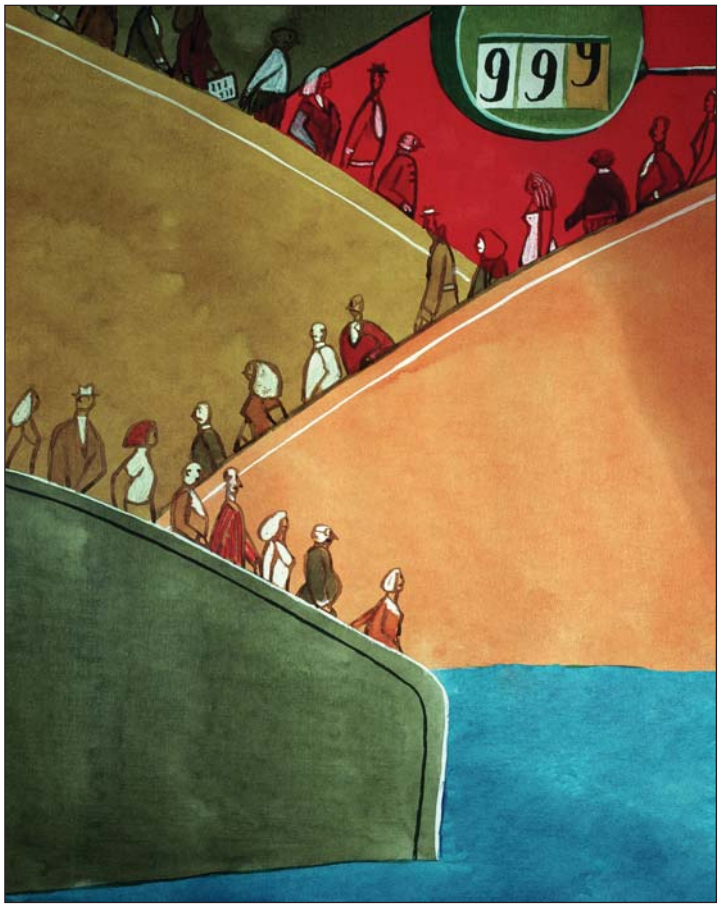
Southwest Economy



Opting Out of Work: What's Behind the Decline in Labor Force Participation?

The labor force participation rate—the share of the adult population that is working or looking for work—has been declining in the United States in recent years.[1] The downward trend has generated concern among some economists and policymakers. The economy grows by adding workers or increasing productivity (or both). Barring other changes, a decline in the share of the population that is economically active translates into a lower rate of economic growth.[2]

Another worry is whether more-vulnerable groups are participating disproportionately in the decline. For middle- and high-income families, less attachment to the labor force may simply reflect a change in priorities or increasing wealth and may not have adverse consequences. For low-income families, on the other hand, dropping out of the labor force can bring about financial distress, lower future earnings and a greater dependence on welfare programs.

(Continued on page 2)

The National Economic Outlook: Continued Growth Likely

Most analysts believe that Hurricanes Katrina and Rita—for all their terrible effects on coastal communities in Louisiana, Mississippi, Texas and Alabama—will have no major lasting impact on overall U.S. economic activity. In its September policy statement, the Federal Reserve System's Federal Open Market Committee, while acknowledging Katrina's possible near-term adverse effect on spending, production and employment, argued that hurricane-related disruptions and uncertainties "do not pose a more persistent threat."

(Continued on page 9)

The National Economic Outlook

(Continued from front page)

This article presents recession probabilities calculated from two different economic forecasting models and uses them to get a sense of the economy's pre- and poststorm strength. The models are very different. The first relies exclusively on the slope of the Treasury yield curve (the difference between the yields on long- and short-term Treasury securities). The second relies on a new measure of oil-supply shocks and on financial indicators other than the yield curve. Both models suggest that the likelihood of continued positive real output growth was high pre-Katrina and that it remains high today.

The Yield Curve and the Probability of Recession

The Yield Curve. The Treasury yield curve shows how the yield on Treasury securities varies with time to maturity. Chart 1, for example, shows yield curves for May 2004, just before the Federal Reserve began raising short-term interest rates, and for August and October 2005. With long-term interest rates drifting generally lower and short-term rates up 300 basis points, the yield curve has flattened sharply over the current policy-tightening cycle. This flattening is a source of concern because there is evidence the yield curve has forecasting power for real economic growth and because an inverted yield curve—which occurs when short-term interest rates exceed long-term rates—has proven to be a reliable recession indicator.[1] (See the box titled "The Yield Curve as an Economic Indicator.")

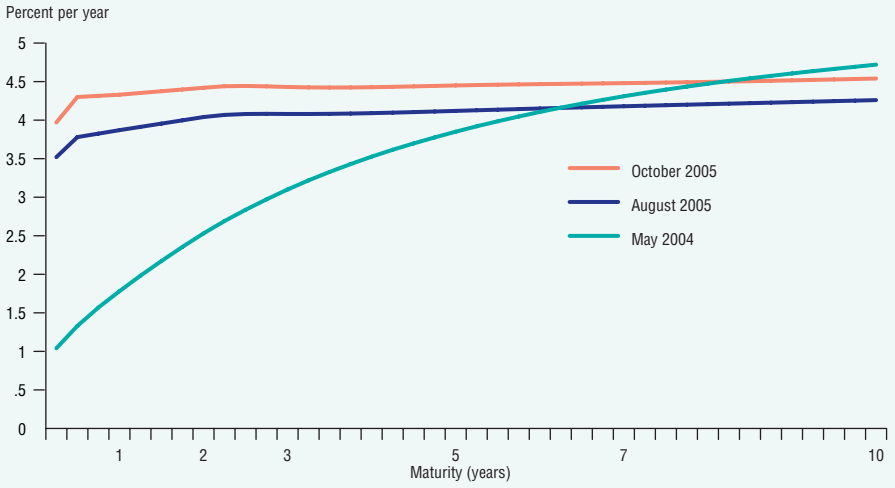
The 10-year minus one-year spread, for example, has turned negative prior to each of the past eight recessions, while giving only one false signal (*Chart 2*). As of August 2005, the spread was 39 basis points—less than one-third its average value for the past 25 years (127 basis points) and less than half its average value for the past 50 years (82 basis points). In October 2005, the spread narrowed further, to 28 basis points.

The Neftçi Method. We have seen that an inverted yield curve has often—but not always—signaled that an economic recession is imminent. Salih Neftçi developed a procedure that can be used to attach a numerical value to the probability of an upcoming recession, based on the yield curve's behavior.[2] To begin, we construct a leading-indicator series that is the cumulative sum of 10-year minus one-year yield-curve spreads. This series obviously increases when the yield spread is positive and decreases when it is negative.[3] To say the yield

Chart 1

The Yield Curve Flattens

(Yields on Treasury securities of various maturities)



SOURCES: Federal Reserve Board; Haver Analytics.

The Yield Curve as an Economic Indicator

It is generally accepted that at horizons of more than a few years, monetary policy primarily influences the rate of inflation and not the course of the real economy. A corollary is that monetary policy affects the 10-year Treasury bond yield mainly through expected inflation. The *real* yield on 10-year bonds—the market yield less expected inflation—varies mostly for nonmonetary reasons (such as changes in long-term productivity trends).

However, financial frictions imply that monetary policy actions can have a temporary impact on short-term real interest rates and, through that channel, influence real economic activity at short horizons. A policy that drives short-term real rates down relative to the 10-year real rate encourages current investment and consumer-durables spending, stimulating real activity. Conversely, a policy that drives short-term interest rates up relative to 10-year real rates discourages current spending and restrains real activity.

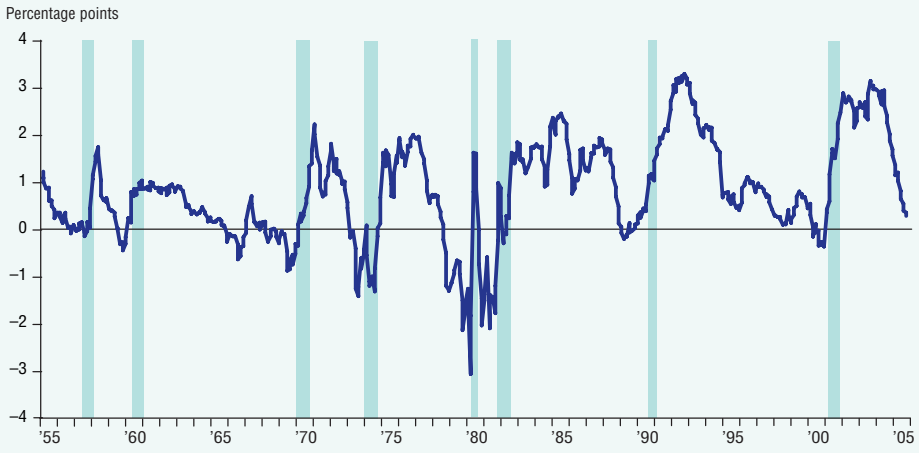
Surveys of professional forecasters suggest that long-term and short-term inflation expectations have tended to move together over the past 20 years.... Consequently,...the slope of the market yield curve...has been a reliable indicator of the difference between real long-term and short-term interest rates and, by the arguments given above, has also been a good guide to the stance of monetary policy and a useful indicator of the economy's future strength.[1]

[1] Excerpted from "Monetary Policy Prospects," by Evan F. Koenig, Federal Reserve Bank of Dallas *Economic and Financial Policy Review*, vol. 3, no. 2, 2004, www.dallasfedreview.org. See also "Predicting Real Growth and Inflation with the Yield Spread," by Sharon Kozicki, Federal Reserve Bank of Kansas City *Economic Review*, Fourth Quarter 1997, pp. 39–57; "Understanding the Term Structure of Interest Rates," by William Poole, Federal Reserve Bank of St. Louis *Review*, September/October 2005, pp. 589–95; and "Why Does the Yield Curve Predict Output and Inflation?" by Arturo Estrella, *Economic Journal*, vol. 115, July 2005, pp. 722–44.

Chart 2

Yield Spread Turns Negative Before Recessions

(10-year Treasury yield minus 1-year Treasury yield)



NOTE: Shaded bars denote recessions.
SOURCES: Federal Reserve Board; Haver Analytics.

An inverted yield curve has often—but not always—signaled that an economic recession is imminent.

curve has inverted prior to every recession is equivalent to saying that our indicator series has turned down before every recession.

Next, we identify cyclical phases in the indicator series. These are the upswings and downswings that correspond to, but generally precede, expansions and contractions in the overall economy, as identified by the National Bureau of Economic Research (NBER). Finally, for each month we calculate the probability that the leading indicator series is in cyclical decline, signaling a future recession.

To start the process, the probability of recession is set equal to zero when the economy is at a cyclical trough. In each subsequent month, the recession probability is revised upward or downward (using a statistical formula called Bayes' rule), depending on how likely it is that the latest yield spread comes from a cyclical down phase. The key point is that knowing the current yield spread is not enough to determine the probability of recession. A low yield spread that is just the most recent of a series of low spreads sends a stronger recession signal than the same low yield spread preceded by a series of high spreads.

Based on our estimates, the probability of recession obtained by applying the Neftçi method to the yield curve rises sharply roughly one year before the onset of NBER contractions. As of August 2005, prior to Katrina, the probability of a recession was only 1.2 percent, so a recession anytime before third quarter 2006 appeared unlikely. October saw a modest further narrowing of the yield spread, raising the probability of recession to 2.4 percent (*Chart 3*).

An Alternative Approach

The Model. As an alternative to assessing the economic outlook by applying the Neftçi method to the yield spread, we regressed average GDP growth over the next two quarters on a variety of financial indicators and a measure of oil-supply shocks, and calculated the implied probability that growth would turn negative. The chief advantage of the alternative approach is that it allows us to bring to bear a wider range of potentially relevant information. An important disadvantage is that we run the risk of overfitting to recent experience.[4]

We forecast two-quarter GDP growth rather than one- or four-quarter growth because over the past 50 years there is a one-to-one correspondence between NBER recessions and episodes in which two-quarter GDP growth dips below zero. This correspondence allows us to interpret our negative-growth probabilities

as recession probabilities similar to those derived using the Neftçi formula.

On the right side of our equation we include the following: (1) the 12-month change in the Standard & Poor's 500 index, divided by nominal GDP; (2) the three-month change in the junk-bond spread (Merrill Lynch high-yield bond index less Moody's AAA corporate bond yield); (3) the three-month change in the real Treasury bill rate (the three-month Treasury bill yield less one-year inflation expectations from a survey of professional forecasters); and (4) an oil-supply-shock variable. We tried including lagged values of GDP growth, the slope of the yield curve and the unemployment rate in the equation, but none of these variables proved to add forecasting power, so all were dropped from the analysis. The estimation period starts in first quarter 1986 and includes two episodes of negative two-quarter annualized GDP growth (corresponding to recessions) and two additional episodes during which growth fell below 1 percent.[5]

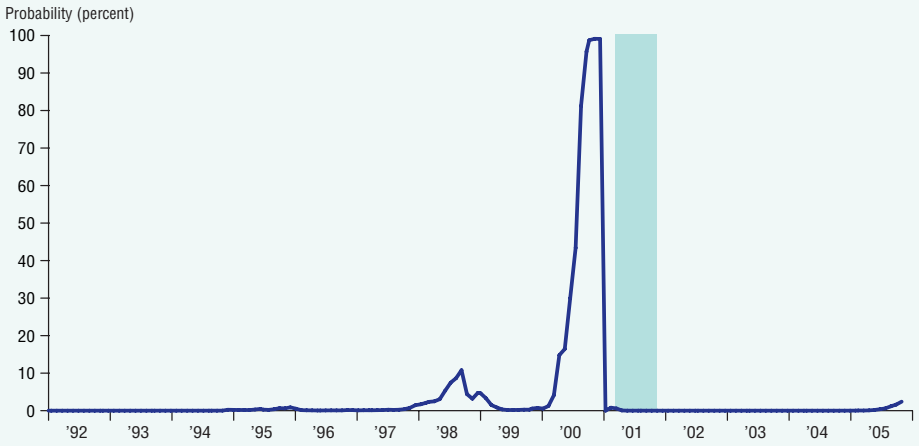
Stock-price appreciation reflects investors' profits-growth expectations and contributes to households' purchasing power. Movements in the junk-bond spread reflect changes in the financial stress felt by marginal corporate borrowers.[6] Changes in real short-term interest rates help capture changes in monetary policy. One would expect future GDP growth to be positively related to stock-price appreciation and negatively related to increases in the junk-bond spread and real three-month Treasury-bill yield. Such is indeed the case in our estimations. (See the box titled "Forecasting GDP Growth.")

There is no consensus on how best to measure oil-price shocks. There is, however, substantial agreement that oil-price increases have a bigger impact on the economy than oil-price decreases and a suspicion that price increases caused by supply disruptions have a bigger impact than those caused by increases in oil demand.[7] In an effort to isolate price changes caused by adverse shifts in supply, the oil-shock variable used here discounts oil-price increases to the extent they are accompanied by increases in U.S. oil consumption. The idea is that shifts in oil demand tend to

Chart 3

Despite Narrowing Yield Spread, Recession Probability Remains Low

(Neftçi formula applied to 10-year minus 1-year spread)



NOTE: Shaded bar denotes a recession.
SOURCE: Authors' calculations.

Forecasting GDP Growth

We have three forecasting equations for real GDP growth: one based on financial data for the first month of the quarter, one based on second-month data and one based on third-month data. Financial-indicator coefficients are restricted to be equal across all three equations—a restriction not rejected by the data. Similarly, the total oil-shock effect—but not its timing—is restricted to be the same across equations. Coefficient estimates reported in the table below are obtained using the full sample period, which runs from first quarter 1986 through second quarter 2005. (However, the probabilities displayed in Chart 5 are based on recursive estimates.)

Coefficient Estimates*

Indicator (lag)	Coefficient	Standard error	*t* statistic
Constant	3.535	.141	25.076
ΔStock prices (–2)	25.487	7.136	3.571
ΔReal short rate (–2)	–.551	.209	–2.635
ΔJunk-bond spread (–2)	–.715	.131	–5.436
First month :			
Oil Shock (–3)	–.008	.004	–2.026
Oil Shock (–4)	–.019	.004	–4.584
Second month:			
Oil Shock (–3)	–.011	.004	–2.979
Oil Shock (–4)	–.015	—	—
Third month:			
Oil Shock (–3)	–.015	.004	–3.771
Oil Shock (–4)	–.012	—	—

Summary Statistics

First month:	Adj. R^2 = 0.630	SE = 0.988	SSR = 64.474
Second month:	Adj. R^2 = 0.638	SE = 0.978	SSR = 62.193
Third month:	Adj. R^2 = 0.618	SE = 1.004	SSR = 65.516

* Dummy variables are used to effectively exclude fourth quarter 1990 through second quarter 1991 and third quarter 2001 through first quarter 2002 from the sample. Iraq's invasion of Kuwait and the 9/11 terrorist attacks had an unforeseeable adverse effect on growth during these periods. Precise definitions of the indicator variables are in the main text.

cause price and quantity to move in the same direction, while shifts in supply cause price and quantity to move in opposite directions. To capture the asymmetry in the economy's response to oil-supply shocks, only positive values of the resultant series are considered.[8]

Chart 4 compares our oil-shock variable to a plot of oil-price increases unadjusted for changes in oil consumption. The two series are scaled so their respective means line up with one another. Note how our adjustment enhances the relative size of the 1990 oil-price spike while shrinking the 1987, 1999–2000, 2002–03 and 2004 increases, attributing them partly to increases in U.S. oil demand. In a head-to-head horse race, our oil-shock variable has predictive power for GDP growth, while the unadjusted price-increase series does not.[9]

The Results. In Chart 5, green bars show periods during which actual two-quarter GDP growth fell below 1 percent (light green) or below 0 percent (dark green). Colored lines, meanwhile, show our forecasting model's assessment of the probability that GDP growth over the next two quarters would fall below 1 percent (the blue line) or below 0 percent (the red line). Since there is a one-to-one correspondence between NBER recessions and episodes of negative two-quarter GDP growth, the red line can also be thought of as our model's estimate of the probability of a recession. As of August 2005, the recession probability was only 2.8 percent—well below the levels reached in December 2000 (15.5 percent), July 2002 (16.4 percent) and June 2005 (6.9 percent). A significant "growth recession" was somewhat more likely, with a 15.6 percent probability of GDP growth below 1 percent as of August 2005—down from 23.3 percent in June. Using October data, the probabilities of an outright recession and a growth recession are only 3.8 percent and 21.3 percent, respectively.

Discussion. Although Charts 3 and 5 are currently telling similar stories about the probability of recession, this clearly has not always been the case. In 2000, for example, Chart 3 shows recession chances soaring to near certainty. Chart 5 suggests that the economy was in a weakened condition, vulnerable to an adverse shock, but that outright recession was far from inevitable. (The economy was equally vulnerable in 2002, according to the chart, but experienced only a period of sluggish growth.)

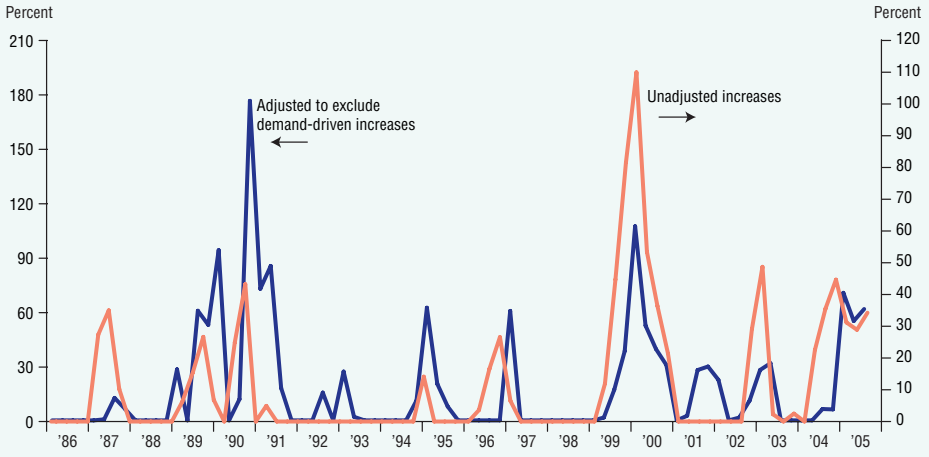
The differences between the charts reflect differences between the underlying models. The yield-curve model behind Chart 3 treats recessions as distinct from expansions, with distinct dynamics. Recessions are triggered by the cumulative effects of financial-market imbalances, signaled by a short-term interest rate that is too high for too long relative to the level of long-term rates. Once these cumulative effects reach a critical level, an economic downturn is all but inevitable. One can question the reliability of the signal and, more deeply, the whole notion of an economic tipping point.

In the forecasting model underlying Chart 5, in contrast, a recession is just a period of unusually slow growth; nothing otherwise distinguishes it from a period of economic expansion. Given this assumption, other variables dominate

Chart 4

Recent Oil-Price Increases Largely Demand-Driven Until 2005

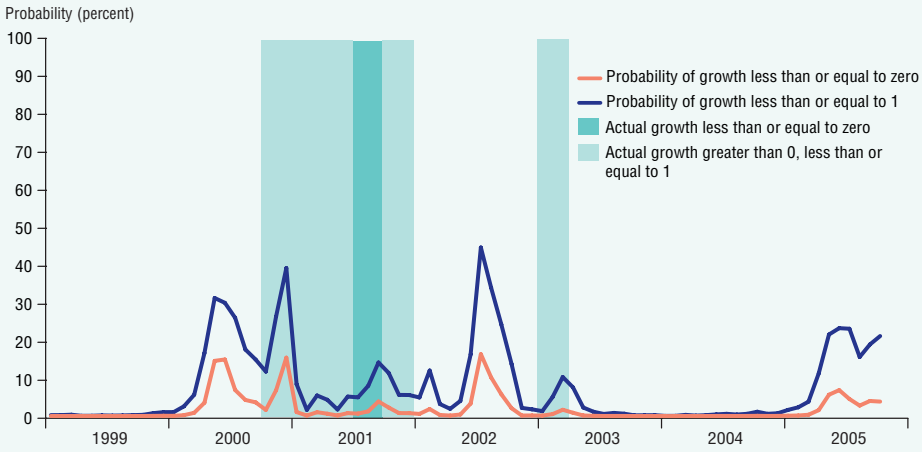
(Four-quarter price increases)



SOURCES: *Wall Street Journal*; Haver Analytics; Department of Energy; Bureau of Economic Analysis; authors' calculations.

Chart 5

Forecasting Model Says Recession and Slow-Growth Risks Both Low



NOTE: The model is estimated recursively from fourth quarter 1998 forward.
SOURCE: Authors' calculations.

the current slope of the yield curve as indicators of the economy's future strength. It is largely coincidence that those other variables now tell much the same story as the yield curve.

Cautious Optimism

Historical links between oil prices, various financial indicators and the real economy suggest that the probability of a recession over the next several quarters is low. Conclusions are basically the same regardless of whether we look at pre- or post-Hurricane Katrina data. This is not to say that Hurricanes Katrina and Rita are unimportant to the economic outlook. Much of the storms' direct adverse impact will be felt at a shorter horizon than that at which our models are designed to forecast.[10] In this sense, the storms slip in under the radar screen of our models. And there is no way we can disentangle the storms' effects from the implications of other economic data released in September.

In any event, the U.S. economy's dynamic nature makes it difficult to predict its future movements. Changes in technology and in environmental and other regulations constantly alter the way energy prices impact the economy and the way it adapts to shocks of all kinds. The standard disclaimer, that past performance is no guarantee of future results, certainly applies.

—Evan F. Koenig
Keith R. Phillips

Koenig is a senior economist and vice president at the Federal Reserve Bank of Dallas, and Phillips is a senior economist at the Bank's San Antonio Branch.

Notes

Thanks go to Harvey Rosenblum, Alan Viard and Steve Brown for helpful comments and Nicole Ball for research assistance.

1 For empirical evidence, see "Predicting U.S. Recessions: Financial Variables as Leading Indicators," by Arturo Estrella and Frederic S. Mishkin, *Review of Economics and Statistics*, vol. 80, February 1998, pp. 45–61.

2 "Optimal Prediction of Cyclical Downturns," by Salih N. Neftçi, *Journal of Economic Dynamics and Control*, vol. 4, November 1982, pp. 225–41.

3 Formally, $LI(t) = LI(t-1) + R10(t) - R1(t)$, where $LI(t)$ is the value of the leading index in period t and $R10(t)$ and $R1(t)$ are the 10- year and one-year interest rates, respectively.

4 Estrella and Mishkin (note 1) question the reliability of multivariate recession-forecasting models partly on these grounds.

5 The start date is driven partly by the limited availability of comparable junk-bond data. However, it offers several other advantages. First, it excludes the pre-1984 period of highly volatile GDP growth, and so avoids statistical problems associated with shifts in the variance of the forecasting equation's error term. Second, the sample period is dominated by a single Federal Reserve chairman. This is important because changes in how monetary policy is conducted can alter the empirical links between financial variables and the real economy. Third, oil prices and oil consumption exhibit increased high-frequency volatility following the 1986 oil-price collapse. By excluding pre-1986 data, we needn't worry about modeling this break in behavior when we construct our oil-shock variable. (See the appendix to this article on the Dallas Fed's web site, www.dallasfed.org.) Finally, the reductions in the energy intensity of the U.S. economy that followed the big oil-price hikes of the 1970s slowed after 1985. (See Alan Greenspan's remarks before the Japan Business Federation, Japan Chamber of Commerce and Industry, and Japan Association of Corporate Executives, Tokyo, Oct. 17, 2005, www.federalreserve.gov.) By starting our sample in 1986, we lessen concerns about a possible gradual weakening of the links between oil prices and economic activity.

Over the sample, there is a total of three quarters during which growth was negative and another eight quarters in which growth was positive but below 1 percent. Over the full sample, then, growth was negative $100 \times 3/79 = 3.8$ percent of the time and was below 1 percent $100 \times 11/79 = 13.9$ percent of the time. The average GDP growth rate is 3.08 percent per year, with a standard deviation of 1.63 percentage points.

6 "The Information in the High-Yield Bond Spread for the Business Cycle: Evidence and Some Implications," by M. Gertler and C. S. Lown, *Oxford Review of Economic Policy*, vol. 15, Autumn 1999, pp. 132–50.

7 "Business Cycles and Energy Prices," by Stephen P. A. Brown, Mine K. Yücel and John Thompson, in *Encyclopedia of Energy*, vol. 1, Cutler J. Cleveland, ed., Elsevier-Academic Press, 2004, and "What Is an Oil Shock?" by J. D. Hamilton, *Journal of Econometrics*, vol. 113, issue 2, 2003, pp. 363–98.

8 Formally, the oil-shock variable is $SHOCK(t) = \max\{0, \Delta P(t) - 17.5 \times \Delta Q(t)\}$, where $\Delta P(t)$ is the four-quarter percentage change in the real price of oil less its sample average and where $\Delta Q(t)$ is the four-quarter percentage change in total U.S. demand for petroleum products less its sample average. The appendix accompanying this article on www.dallasfed.org gives details of the derivation.

9 We obtain similar results in a head-to-head comparison with an oil-shock variable suggested by Hamilton (note 7), which counts only oil-price increases that are not merely a reversal of recent price declines.

10 The Congressional Budget Office estimates that the hurricanes will knock between 0.17 and 0.26 percentage points off GDP in the second half of 2005. Then, recovery efforts will boost first-half 2006 GDP by between 0.19 and 0.28 percentage points, relative to baseline.